

XIV. *An account of the Fishes of the States of Central America, based on collections made by Capt. J. M. DOW, F. GODMAN, Esq., and O. SALVIN, Esq. By ALBERT GÜNTHER, M.A., M.D., Ph.D., F.R.S., F.Z.S.*

Read March 22nd, 1864, and December 13th, 1866.

[PLATES LXIII. to LXXXVII.]

§ 1. *Introductory Historical Remarks on the Collections forming the basis of this Memoir.*

BEFORE proceeding to the enumeration and description of the fishes known to exist in the States of Central America, I may be permitted briefly to notice the circumstances which enable me to submit to the Society the results contained in the present memoir.

Mr. Salvin started in the year 1859 on his second excursion to Guatemala, chiefly with the intention of working out the ornithological fauna of that country. But having had his attention directed by me to the fact that its cold-blooded vertebrates were almost entirely unknown, he made and brought home a small collection of reptiles and fresh-water fishes, which proved to be of sufficient interest to encourage him to pay still more attention to this subject on a third excursion, which he undertook in company with Mr. Godman in the year 1861. By far the greater part of the materials which form the basis of this memoir were obtained on this occasion. Not only did the two travellers extend their excursions to various parts of Guatemala, but Mr. Salvin also visited Panama, where he met and collected in company with Capt. Dow, of the Panama Railway Company's Steamer 'Guatemala.'

Capt. Dow, indeed, had commenced to collect fishes previously to this, having sent several collections to the Smithsonian Institution in Washington, and to the Zoological Society of London, whence they were transferred to the British Museum; and for the last three years he has continued his researches with such zeal and liberality that I cannot abstain from acknowledging here the great services he has rendered to the cause of science.

The collections made by these gentlemen contained not less than about 1500 examples, in a perfect state of preservation, many of considerable size. In addition to these, I have examined a few which had been purchased of a dealer for the British Museum having been collected at Puerto Cabello in the Bay of Honduras, and, finally, those collected by Dr. Seemann, originally deposited in the Collection of Haslar Hospital, and now in the British Museum. The latter have lost much of their scientific value, as, unfortunately, no record was kept of the localities where they were obtained; and only in a few cases have I been able to avail myself of specimens of this collection, viz. where the original label, with the name of the collector, has been accidentally preserved.

§ 2. *Topographical Features of the Localities explored.*

As regards the topographical features of the localities explored by Messrs. Dow, Godman, and Salvin, I have been favoured by the latter gentleman, by whom also the accompanying map has been prepared, with the following notes:—

Lakes.

AMATITLAN.—The Lake of Amatitlan is situated in lat. $14^{\circ} 29' N.$, long. $90^{\circ} 35' W.$, in the Republic of Guatemala. Its elevation above the sea-level is about 4500 feet. Being only a short distance on the southern side of the main ridge, it collects the waters of a few small streams, which it discharges at its southern extremity, into the river Michatoya, a mountain-torrent for half its course, then expanding, like all the rivers of Guatemala which flow into the Pacific, into a broad shallow stream with a shifting sandy bed. The lake is very deep, and its water clear. The volcanoes of Pacaya and Agua rise amongst the mountains of its southern border, the whole forming a landscape of great beauty. Fish are caught during the rainy season near the outlet into the river Michatoya, and are sent to the market of the City of Guatemala.

ATITLAN.—The Lake of Atitlan is elevated 5000 feet above the sea. Like the last-mentioned it lies in Guatemala on the southern side of the main ridge, in lat. $14^{\circ} 43' N.$, long. $91^{\circ} 14' W.$ It has no visible outlet. The water is clear and fresh, and the lake of great depth. The hills on three sides attain to a height of 2000 feet above the lake. On its southern border the two large volcanoes of Toliman and S. Pedro rise, their bases being washed on one side by the lake, giving one the idea that one of them (that called Toliman) has in rising acted as a dam and stopped the outflow of the waters of a mountain-valley. A few small streams enter the lake, the water of which rises during the rainy season, to fall again in the dry. On the mountain-slope below, several streams take their rise, supplied probably by the filtration of water from the lake; but it would appear, from the alteration of the water-level in accordance with the season of the year, that it is chiefly influenced by evaporation. A number of Indian villages surround the lake; at one of them, Panajachel, a small collection of fish was made. Fish never seem to grow to any size in this lake, the Mojara (*Heros*) being quite diminutive. The Indians fish with round nets amongst the reeds that grow at the mouths of small streams. The lake itself is about twenty-two miles long, and twelve miles wide.

DUEÑAS.—This lake is little more than a depression in one of the elevated (5000 ft.) plains forming the tablelands of Guatemala. Its depth is nowhere more than 6 feet, and its banks are everywhere clothed with reeds. A small stream connects the lake with the river Guacalate. Here, too, fish are caught by the Indians in round nets, which are held by both hands, pushed in amongst the reeds, and suddenly brought to the surface.

HUAMUCHAL.—This name applies properly to a series of small lakes situated in about lat. $14^{\circ} 32' N.$, long. $92^{\circ} 13' W.$, close to one another, about six miles from the mouth of the river Tilapa on the Pacific coast. The place is not shown on any map; but it is near

the large Lake of Tamachian, with which, in the rainy season, all these smaller lakes are connected. During this period of the year the river Tilapa overflows its banks and inundates the whole country round. In the dry season water remains in depressions of the land, forming the lagoons of Huamuchal; but in years of great drought even these dry up, the fish being destroyed; but a fresh supply finds its way from Lake Tamachian during the next inundation. The water is slightly brackish. The fish are taken in drag-nets, salted, and sold to Indians coming from the Altos of Guatemala.

MANAGUA.—According to Mr. J. Bailey this lake is about fifty or sixty miles long, by thirty-five miles wide. Its depth varies from 2 to 10 and 15 fathoms, but in its deepest part reaches to as much as 40 fathoms. Its elevation above the sea is 156 feet. On its south-western border the lake is separated from the Pacific by a series of comparatively low hills, the lowest section of which, through the Plain of Leon, is only 230 feet above the ocean-level. The high mountains of the Republic of Honduras approach the north-eastern border of the lake. On its south-eastern side an opening communicates with the Lake of Nicaragua. Commencing with the Fall of Tipitapa, of 22 feet height, the river widens into the Estero of Panaloya, and thence into the larger lake.

NICARAGUA.—The same authority gives a length of one hundred and five miles to this lake, and a width of about forty-five, its depth being about 15 fathoms. The surface of the lake is studded with numerous islands, some of them, as Omotepec, being volcanic cones. The elevation of the lake above the mean ocean-level is given as 128 feet. The same line of low hills which divides Lake Managua from the Pacific separates Lake Nicaragua from the same ocean; but at no point is the elevation so low as at that above indicated. The river San Juan, a deep stream with several rapids, flows out of the south-eastern end of the lake, and falls into the Atlantic Ocean, at the port of Greytown, or San Juan del Norte.

PETEN.—The Lake of Peten is situated in lat. $17^{\circ} 10' N.$, long. $90^{\circ} W.$, and is one of several lakes formed at the base of the Promontory of Yucatan. Its length is about thirty miles, its width eight miles, and elevation above the sea 500 feet. The water is quite fresh, clear, and of considerable depth. Neither the Lake of Peten nor the adjoining Lake of Yasha has any outlet; and in both the water is rapidly increasing in expanse—so much so that several streets of the town of Flores, which stands on an island in Lake Peten, have been absorbed within a few years, and the posts of huts, which formerly were on dry ground, may now be seen standing in deep water. This increase of water can only be accounted for by supposing that a common subterranean outlet has been stopped up, or that the land of this district is experiencing a gradual subsidence. All the fish obtained here were caught with a hook and line, or speared. All the natives, even quite small children, are very expert in using a light spear formed of bamboo cane with an iron barb at the end.

YABAL.—This lake, which is also called the Golfo Dulce, is about thirty or forty miles long, and ten to fifteen miles wide, and has a tolerably uniform depth of about 35

to 40 feet. It is situated in lat. $15^{\circ} 30' N.$, long. $89^{\circ} 15' W.$, at the bottom of the Bay of Honduras. One large river, the Polochic, enters this lake; and it has a narrow but deep outlet to the sea, called the Rio Dulce, which is navigated by small schooners plying between Belize and the town of Yzabal. It was near this last-mentioned place that a few species of fish were obtained.

Rivers.

BAYANO.—This is a river which rises in the narrow part of Central America, and flows into the Pacific a little to the southward of the Bay of Panama.

CAHABON.—The town of Cahabon, where a few fishes were obtained, is situated on an affluent of the river which bears this name. The main stream rises in the same marsh as the Polochic, but takes another valley, in Vera Paz, and again joins the Polochic, when they both flow into the Lake of Yzabal, and thence into the Atlantic.

CHAGRES.—This is the principal river of the Isthmus of Panama. It flows into the Atlantic. The fish were obtained near the railway bridge at Barbacoas, about halfway across the isthmus.

CHISOY.—Of the numerous names this river bears, I have chosen this for the principal stream which forms the large river that flows out into the Laguna de los Terminos, in the Bay of Campeachy. This branch is also known as the Rio Negro; and after receiving the water of the Rio de la Pasion, or Rio de Santa Isabel, as it is also called, the two are usually called the Usumacinta. Fishes were collected from this river near the Indian village of Cubulco; and a number were also procured by poisoning with herbs a small stream near Saouchil, an Indian village below the town of Coban, in Vera Paz.

GUACALATE.—Is one of the numerous rivers which drain the southern watershed of the main ridge into the Pacific. It flows past Antigua, the old capital of Guatemala. Fishes were obtained about 3500 feet above the sea, where the river is still quite a torrent.

MOTAGUA.—This river, the second largest in Guatemala, rises in the main ridge, and flows, with high mountains on either side, nearly due eastward into the Atlantic. Fishes abound in this river; and nearly every year a considerable length is poisoned, and a large quantity obtained. On one of these occasions a collection was made a little below the bridge over which the highroad from Guatemala to Vera Paz passes. Another collection came from lower down the stream, below the village of Tocoy.

SAN GERONIMO.—Is a tributary of the Chisoy before mentioned. A small collection was made near the village of San Geronimo, in a plain at the foot of the mountains whence it takes its rise.

SANTA ISABEL.—A small stream flowing into this river, one of the principal branches of the Usumacinta, was poisoned, and a number of small fishes obtained.

SAN SALVADOR.—A few small fishes were caught by Capt. Dow in a warm stream near the capital town of this republic.

Marine localities.

BELIZE.—All fishes from Belize were from the market, and were caught amongst the coral reefs which line this coast.

CARDON¹ ISLAND.—Is situated at the mouth of the fine harbour of Realejo, in Nicaragua. Fishes were found at low tide in the pools amongst the rocks, and caught with a landing-net.

CHIAPAM.—The whole coast of Guatemala, bordering the Pacific Ocean, is studded with a number of lagoons formed at the mouths of the numerous rivers which flow down from the neighbouring mountains. All these rivers are charged with volcanic sand, which is thrown back by the heavy surf that rolls in on this coast. The body of water brought down during the dry season is often insufficient to reduce this sandbar; and it frequently happens that all outlet to the sea is stopped. The accumulation of water during the rainy season breaks this barrier; but it again forms when the water subsides. About the period of the cessation of the rains the natives cut an artificial channel, which, at first widening of itself, often remains open some months, each tide bringing a great quantity of fishes into the lagoon, which are there netted by drag-nets. The water is almost salt, but varies in this respect according to the size of the river which enters it. A few fishes were also obtained by a hook and line from a canoe in the open sea.

LIBERTAD.—This is an open roadstead, the port of the City of San Salvador. Whilst we were lying at anchor here a few fishes were caught with a hook and line.

PANAMA.—Most of the fishes taken in the Bay of Panama were found in the pools amongst the rocks at low tide. A reef running out from the town was an excellent locality; one spring tide Capt. Dow and I secured twenty-four species in the course of half an hour.

SAN JOSÉ.—Is the port of Guatemala on the Pacific side; a few fishes were caught here in the open sea in a canoe.

§ 3. *Definition of the Boundaries of the Fauna treated of in this Memoir.*

Although we may presume that our account contains a tolerably complete list of the species inhabiting the localities visited, particularly as on several occasions poison (the best means for securing a complete series of the fishes of a certain locality) was resorted to, yet there is still a wide field for future explorers in a country where several forms (such as *Heros*, *Pimelodus*, and the *Cyprinodontes*) are so much developed and specialized. Of the fishes of Yucatan we still know absolutely nothing. The list of the marine fishes of the Atlantic coast will, without doubt, be considerably swelled, as the gentlemen mentioned paid much less attention to the Atlantic marine fauna (which would have yielded comparatively few novelties) than to the freshwater fauna. And knowing how little advantage is derived from, and how much confusion is caused by, receiving into a

¹ This name is misspelt "Cardova" in several places in the 3rd volume of the 'Catalogue of Fishes.'—A. G.

fauna species which may be *expected* to belong to it, although they are not yet discovered within its limits, I have excluded all species not actually known from Guatemala, although they have been obtained north and south of it. A collection made by Mr. Godman at Belize was of great value in determining this part of the fauna.

Numerous species of fishes have been described from Mexico¹; and if we were better acquainted with their geographical distribution, it would have been useful to treat at least of the southern portion of them, in conjunction with the Guatemalan species. Unfortunately but a small proportion of the exact localities are known, so that at present no line can be drawn to indicate where the preponderance of nearctic types over tropical ones terminates. Thus, confining myself to the fishes occurring between the political boundary of Guatemala in the north and the Isthmus of Darien in the south, I would repeat that, previously to the receipt of the collections forming the basis to this Memoir, only a small number had been described, as will be seen from the following remarks:—

§ 4. *Historical account of Publications previous to this Memoir.*

It would be of but little advantage to enumerate the few isolated species incidentally described in general works or memoirs as occurring in Guatemala or Panama. However, I must mention that the first traveller who collected fishes in these states appears to have been Baron von FRIEDRICHSTHAL. I am not aware that any account of his travels has been published; but in a paper published by the late JACOB HECKEL in 'Annalen des Wiener Museums,' vol. ii. 1840, a single species is described, which is stated to be from Friedrichsthal's Central-American Collection, and which I have recognized as belonging to the Lake-Peten fauna (*Heros friedrichsthalii*). The greater part of the collection made by this gentleman evidently remained unpublished until 1864, when Dr. F. STEINDACHNER determined from it four other species (Denkschr. Akad. Wiss. Wien, xxiii.), viz. :—*Heros wropphthalmus* (Gthr.), *Heros triagramma* = *H. salvini* (Gthr.), *Heros melanopogon*, and *Petenia splendida* (Gthr.). As we have received four of these species from Lake Peten, it is very probable that Baron Friedrichsthal visited and collected in that locality.

In the second place I have to mention Dr. SEEMANN, who, as naturalist attached to the expedition of the 'Herald,' brought to England a collection of Central-American fishes. These, as I have mentioned above, were originally deposited in the collection of Haslar Hospital, but no record as regards the origin of the specimens was kept, so that most of them are lost for the purposes of this Memoir.

In the year 1861 I received the first collections from Mr. SALVIN and Capt. Dow. The species belonging to the families treated of in the 3rd volume of the 'Catalogue of Fishes' were described therein; and a separate account of those sent by the latter

¹ Prof. Troschel enumerates some 130 freshwater and marine species in Müller's 'Reisen in den Vereinigten Staaten,' &c.

gentleman from the Pacific Coast of Central America was published in the Society's 'Proceedings' for 1861 (Nov. 26); it contained fourteen species, ten of which were new.

In the following year the 4th volume of the 'Catalogue of Fishes' was published, containing the descriptions of those species of Pharyngognaths and Anacanthines which had arrived from our travellers, who were then engaged in collecting.

In the year 1863 Mr. GILL published a descriptive enumeration of a collection of "Fishes from the western coast of Central America, presented to the Smithsonian Institution by Capt. J. M. Dow." He distinguished in it the following twenty-five species, of which I consider eighteen to have been new to science (Proc. Ac. Nat. Se. Philad. 1863, p. 162):—

1. *Diapterus dowii*, sp. n. = *Gerres dowii*.
2. *Pomacanthodes zonipectus*, Gill.
3. *Centropomus armatus*, sp. n.
4. *Epinephelus analogus*, sp. n. = *Serranus analogus*.
5. *Promicropterus decoratus*, sp. n. = *Rhypticus decoratus*.
6. *Bairdiella armata*, sp. n. = *Corvina armata*.
7. *Ophioscion typicus*, sp. n. = *Corvina ophioscion*.
8. *Amblyscion argenteus*, sp. n.
9. *Caranx panamensis*, Gill, = *Caranx speciosus* (Forsk.).
10. *Carangoides dorsalis*, sp. n.
11. *Carangus marginatus*, Gill, = *Caranx hippos*, L., var.
12. *Oligoplites inornatus*, sp. n. = *Chorinemus inornatus*.
13. *Exocætus dowii*, sp. n.
14. — *albidactylus*, sp. n. ? = *E. bahiensis* (Ranz.).
15. *Upeneus grandisquamis*, sp. n.
16. *Trichidion opercularis*, sp. n. = *Polynemus opercularis*.
17. — *approximans* = *Polynemus approximans* (Lay & Benn.).
18. *Mugil guentherii*, Gill, = *M. brasiliensis* (Agass.).
19. *Batrachoides pacifici* = *Batrachus pacifici* (Gthr.).
20. *Dormitator microphthalmus*, Gill, = *Eleotris maculata* (Bl.).
21. *Leptarius dowii*, sp. n. = *Arius dowii*.
22. *Sciades troschelii*, sp. n. = *Arius troschelii*.
23. *Ælurichthys panamensis*, sp. n.
24. *Atractosteus tropicus*, sp. n. = *Lepidosteus tropicus*.
25. *Urotrygon mundus*, sp. n.

At later periods Mr. Gill has described some other species incidentally, which will be referred to in the general list.

A small collection made by Prof. M. WAGNER on the Isthmus of Panama, between 7° and 9° lat. N., and 77° and 83° long. W., was examined by Messrs. KNER & STEIN-

DACHNER, who gave a preliminary account of it in 'Sitzgsber. bayer. Akad. Wiss.' 1863, pp. 220-230, and more detailed descriptions in 'Abhandl. bayer. Akad. Wiss.' 1864(1865), pp. 1-61. Prof. M. Wagner added, besides, a detailed account of the hydrographical peculiarities of this part of Central America (pp. 65-92). The species treated of in these Memoirs are the following:—

1. *Pristipoma humile*, sp. n.
2. *Dajaus elongatus* (K. & St.)=*Agonostoma nasutum* (Gthr.)
3. *Dajaus monticola* (C. & V.).
4. *Acara cæruleopunctata*, sp. n.
5. *Heros altifrons*, sp. n.
6. *Heros sieboldii*, sp. n.
7. *Eleotris pictus*, sp. n.
8. *Engraulis macrolepidotus*, sp. n.
9. — *poeyi*, sp. n.
10. *Xiphophorus gillii*, K. & St.,=*Pæcilia*, sp. ?
11. *Macrodon brasiliensis*, K. & St.,=*M. microlepis* (Gthr.).
12. *Saccodon wagneri*, sp. n.
13. *Pseudochalceus lineatus*, sp. n.
14. *Chalcinopsis striatulus*, sp. n.
15. — *chagrensis*, sp. n.
16. *Chalceus atrocaudatus*, sp. n.
17. *Tetragonopterus æneus* (Gthr.).
18. — *gronovii* (C. & V. ?).
19. *Bagrus* (?)*arioides*, sp. n.=*Arius multiradiatus* (Gthr.).
20. *Pimelodus modestus* (Gthr.)
21. — *cinerascens* (K. & St.)=*P. wagneri* (Gthr.).
22. *Loricaria uracantha*, sp. n.
23. — *lima* (Kner).
24. *Hypostomus plecostomus* (K. & St.)=*Plecostomus*, sp.
25. *Ancistrus cirrhosus* (C. & V.).
26. *Acanthias vulgaris* (Risso ?).

Finally, having received in 1864 the last collections made by Messrs. Godman & Salvin, I gave preliminary notices of the new species in the 'Proceedings' of this Society, embodying the numerous contributions to our knowledge of the Siluroids and Characinoids in the fifth volume of the 'Catalogue of Fishes,' to which were added the Cyprinodontes and Scombresocides in the sixth (1865-66).

§ 5. *General List of Central-American Fishes.*

After these introductory remarks on the contributions to the ichthyology of Central

America preceding this Memoir, I at once proceed to give a list of all the species known to exist in these countries. There are comparatively few which I do not know from autopsy; their names are printed in italics. An asterisk (*) marks those which are described or remarked upon. The second column contains chiefly the names of the localities where they have been found within the limits of Central America. The localities of species occurring on both sides of the Isthmus are printed in italics; of these I shall treat again subsequently. Finally, the letter M signifies that a species is marine, B that it is known from brackish, and F that it is from fresh water.

ACANTHOPTERYGII.

Fam. PERCIDÆ.

CENTROPOMUS, *Cuv.*

- 1. **appendiculatus, Poey* . . . Chagres R. (Cuba, Mex., Surin.) . . . F. & M.
- 2. **medius, Gthr.* . . . Chiapam . . . B.
- 3. **nigrescens, Gthr.* . . . Chiapam . . . B.
- 4. **parallelus, Poey* . . . Chagres R. (W. Indies, Bahia) . . . F. & M.
- 5. **armatus, Gill* . . . Chiapam . . . B.
- 6. **ensiferus, Poey* . . . Belize (Cuba, Jamaica, Guyanas) . . . B.

CENTROPRISTIS, *Bris. de Barnev.*

- 7. **macropoma, Gthr.* . . . Panama . . . M.

SERRANUS, *Cuv.*

- 8. **creolus, C. & V.* . . . *Atl. & Pac.* . . . M.
- 9. *striatus, Bl.* . . . *Atlant.* . . . M.
- 10. *coronatus, C. & V.* . . . *Atlant.* . . . M.
- 11. *undulosus, C. & V.* . . . *Atlant.* . . . M.
- 12. **sellicauda, Gill* . . . Pacific Coast . . . M.
- 13. **analogus, Gill* . . . Pacific Coast . . . M.?

PLECTROPOMA, *Cuv.*

- 14. **afrum, Bl.* . . . *Atl. & Pac.* . . . M.

RHYPTICUS, *Cuv.*

- 15. **decoratus, Gill* . . . Pacific Coast . . . M.

MESOPRION, *Cuv.*

- 16. *chrysurus, Bl.* . . . *Atlant.* . . . M.
- 17. *griseus, C. & V.* . . . *Atl. & Pac.* . . . M.
- 18. *uninotatus, C. & V.* . . . *Atl. & Pac.* . . . M.
- 19. **aratus, Gthr.* . . . Chiapam, Panama . . . M. & B.
- 20. *vivanus, C. & V.* . . . *Atlant.* . . . M.

APOGON, *Lacép.*

- 21. **dovii, Gthr.* . . . Pacific Coast . . . M.

Fam. PRISTIPOMATIDÆ.

PRISTIPOMA, *Cuv.*

22. *melanopterum, <i>C. & V.</i>	<i>Atl. & Pac.</i>	M.
23. *virginicum, <i>L.</i>	<i>Atl. & Pac.</i>	M.
24. *dovii, <i>Gthr.</i>	Panama :	M.
25. *chalceum, <i>Gthr.</i>	Panama .	M.
26. *humile, <i>Kner & Steind.</i>	Rio Bayano .	F.
27. *macracanthum, <i>Gthr.</i>	Chiapam .	B.
28. crocro, <i>C. & V.</i>	Rio Motagua (Trop. Amer., Atlant.)	F., B., & M.
29. *leuciscus, <i>Gthr.</i>	San José, Chiapam, Panama .	B.

CONODON, *C. & V.*

30. *pacifici, <i>Gthr.</i>	Chiapam .	B.
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HÆMULON, *Cuv.*

31. chromis, <i>Brouss.</i>	Atlant. .	M.
32. canna, <i>C. & V.</i>	Atlant. .	M.
33. xanthopterus, <i>C. & V.</i>	Atlant. .	M.
34. *brevirostrum, <i>Gthr.</i>	Panama, Puerto Cabello .	M.
35. *margaritifera, <i>Gthr.</i>	Panama .	M.

LOBOTES, *Cuv.*

36. auctorum, <i>Gthr.</i>	Atlant. (India) .	B.
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Fam. SQUAMIPINNES.

CHÆTODON, *Cuv.*

37. striatus, <i>L.</i>	Atlant. .	M.
38. capistratus, <i>L.</i>	Atlant. .	M.
39. *humeralis, <i>Gthr.</i>	Panama (Sandwich Isl.) .	M.

POMACANTHUS, *Lacép.*

40. paru, <i>Gthr.</i>	Atlant. (Colon) .	M.
41. *zonipectus, <i>Gill</i>	Pac. .	M.

EPHIPPUS, *Cuv.*

42. faber, <i>Bl.</i>	Atlant. (Belize) .	M.
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Fam. MULLIDÆ.

UPENEUS, *C. & V.*

43. *tetraspilus, <i>Gthr.</i>	Panama .	M.
44. *grandisquamis, <i>Gill</i>	Panama .	M.

Fam. SPARIDÆ.

SARGUS, *Cuv.*

45. unimaculatus, <i>Bl.</i>	Atlant. (Belize) .	M.
46. aries, <i>C. & V.</i>	Atlant. (Belize) .	M.

CHRYSOPHRYS, *Cuv.*

47. *calamus, <i>C. & V.</i>	<i>Atl. & Pac.</i> (Panama) .	M.
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PIMELEPTERUS, *Cuv.*

48. boscii, <i>Lacép.</i>	<i>Atl. & Pac.</i> (Chiapam & Panama) .	M.
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Fam. CIRRHITIDÆ.

CIRRHITICHTHYS, *Blkr.*

49. *rivulatus, *Val.* Galapagos Islands, Panama M.

Fam. SCORPÆNIDÆ.

SCORPÆNA, *Art.*

50. plumieri, *Bl., Schn.* *Atl. & Pac.* (Panama) M.

Fam. POLYNEMIDÆ.

POLYNEMUS, *L.*

51. *melanopoma, *Gthr.* San José M.
 52. *approximans, *Lay & Benn.* Pacif., Chiapam, Panama M.
 53. *opercularis, *Gill.* Pacif. . . . M.

Fam. SCLÆNIDÆ.

LARIMUS, *C. & V.*

54. *brviceps, *C. & V.* *Atl. & Pac.* (Panama) M.

MICROPOGON, *Cuv. & Val.*

55. undulatus, *L.* Atlant. . . . M. & F.
 56. *altipinnis, *Gthr.* Chiapam, San José, Panama M. & B.

UMBRINA, *Cuv.*

57. *elongata, *Gthr.* Chiapam B.
 58. *nasmus, *Gthr.* Panama M.
 59. *analis, *Gthr.* Pauama M.

CORVINA, *Cuv.*

60. ronchus, *C. & V.* Atlant. . . . M.
 61. *chrysoleuca, *Gthr.* Panama M.
 62. *vermicularis, *Gthr.* Panama M.
 63. *armata, *Gill.* Pacif.
 64. *ophioscion, *Gthr.* Panama M.

OTOLITHUS, *Cuv.*

65. *squampinnis, *Gthr.* Panama M.
 66. *albus, *Gthr.* Chiapam B.
 67. *reticulatus, *Gthr.* San José, Chiapam M. & B.

Fam. ACRONURIDÆ.

ACANTHURUS, *Schn.*

68. chirurgus, *Bl.* Atlant. . . . M.

Fam. CARANGIDÆ.

CARANX, *Gthr.*

69. crumenophthalmus, *Bl.* *Atl. & Pac.* M.
 70. amblyrhynchus, *C. & V.* Atlant. . . . M.
 71. *leucurus, *Gthr.* Panama M.
 72. *speciosus, *Forsk.* From Panama to East Africa M.

73. carangus, <i>Bl.</i>	<i>Atlant. & Ind. Occ.</i> (Chiapam & Belize)	M.
74. *hippos, <i>L.</i>	<i>Tropics generally</i>	M.
75. *caballus, <i>Gthr.</i>	Panama	M.
76. *caninus, <i>Gthr.</i>	Panama	M.
77. *dorsalis, <i>Gill</i>	San Diego (Cal.), Panama	M.
ARGYRIOSUS, <i>Lac.</i>		
78. vomer, <i>L.</i>	<i>Atl. & Pac.</i> (Belize, Chiapam, Panama)	B. & M.
79. setipinnis, <i>Mitch.</i>	<i>Atl. & Pac.</i> (Panama)	M.
CHORINEMUS, <i>C. & V.</i>		
80. occidentalis, <i>L.</i>	<i>Atlant.</i>	M.
81. saliens, <i>Bl.</i>	<i>Atlant. & Pac.</i> (Chiapam, Isabel)	B. & F.
82. *altus, <i>Gthr.</i>	Panama	M.
83. *inornatus, <i>Gill</i>	Panama	M.
TRACHYNOTUS, <i>C. & V.</i>		
84. ovatus, <i>L.</i>	<i>Atl., Pac., & Ind. Oc.</i> (Panama)	M.
85. *fasciatus, <i>Gill</i>	Panama, San José	M.

Fam. SCOMBRIDÆ.

PELAMYS, <i>C. & V.</i>		
86. *sarda, <i>Bl.</i>	<i>Atl. & Pac.</i>	M.
CYBIUM, <i>Cuv.</i>		
87. maculatum, <i>Mitch.</i>	<i>Atlant.</i> (Belize)	M.
ECHENEIS, <i>Art.</i>		
88. remora, <i>L.</i>	<i>Atl., Pac., & Ind. Oc.</i>	M.
89. naucrates, <i>L.</i>	<i>Atl., Pac., & Ind. Oc.</i>	M.

Fam. BATRACHIDÆ.

BATRACHIUS, <i>Gthr.</i>		
90. *pacifici, <i>Gthr.</i>	<i>Panama, West Coast of Africa</i>	M.
91. surinamensis, <i>Bl. Schn.</i>	<i>Atl. & Pacif.</i> (Panama)	M.
*THALASSOPHRYNE, <i>Gthr.</i>		
92. *maculosa, <i>Gthr.</i>	Puerto Cabello	M.
93. *reticulata, <i>Gthr.</i>	Panama	M.
PORICHTHYS, <i>Girard.</i>		
94. porosissimus, <i>C. & V.</i>	<i>Atl. & Pac.</i>	M.

Fam. PEDICULATI.

ANTENNARIUS, <i>Commers.</i>		
95. *leopardinus, <i>Gthr.</i>	Panama	M.
96. *tenuifilis, <i>Gthr.</i>	Panama	M.

Fam. GOBIIDÆ.

GOBIUS, <i>Art.</i>		
97. soporator, <i>C. & V.</i>	<i>Atl. & Pac.</i> (Panama)	M. & B.
98. paradoxus, <i>Gthr.</i>	Panama	M.

99. <i>mexicanus</i> , <i>Gthr.</i>	Mexico, Rio Motagua	F.
100. <i>seminudus</i> , <i>Gthr.</i>	Panama	M.
EUCTENOGOBIOUS, <i>Gill.</i>		
101. <i>sagittula</i> , <i>Gthr.</i>	Panama	M.
SICYDIUM, <i>C. & V.</i>		
102. <i>plumieri</i> , <i>Bl.</i>	Atl. & Pac. (Panama)	M.
ELEOTRIS, <i>Cuv.</i>		
103. <i>*maculata</i> , <i>Bl.</i>	Atl. & Pac. (Huamuchal)	B.
104. <i>somnolenta</i> , <i>Girard</i>	Atl. & Pac. (Cardon)	M.
105. <i>dormitatrix</i> , <i>Bl.</i>	Atl. (Rio Motagua, Yzabal)	F. & B.
106. <i>*longiceps</i> , <i>Gthr.</i>	Lake of Nicaragua	F.
107. <i>*picta</i> , <i>Kner</i>	Rio Bayano	F.
108. <i>*seminuda</i> , <i>Gthr.</i>	Panama	M.
AMBLYOPUS, <i>C. & V.</i>		
109. <i>*brevis</i> , <i>Gthr.</i>	Panama	M.

Fam. BLENNIIDÆ.

BLENNIUS, <i>Artedi.</i>		
110. <i>brevipinnis</i> , <i>Gthr.</i>	Pacif.	M.
SALARIAS, <i>Cuv.</i>		
111. <i>atlanticus</i> , <i>C. & V.</i>	Atl. & Pac.	M.
CLINUS, <i>Gthr.</i>		
112. <i>nuchipinnis</i> , <i>Q. & G.</i>	Atl. & Pac.	M.
113. <i>delalandii</i> , <i>C. & V.</i>	Atl. & Pac.	M.
114. <i>*macrocephalus</i> , <i>Gthr.</i>	Panama	M.
CREMNOBATES, <i>Gthr.</i>		
115. <i>*monophthalmus</i> , <i>Gthr.</i>	Panama	M.

Fam. SPHYRÆNIDÆ.

SPHYRÆNA, <i>Artedi.</i>		
116. <i>picuda</i> , <i>Bl.</i>	Atl.	M.
117. <i>forsteri</i> , <i>C. & V.</i>	Ind. Oc. & Pac. (Chiapam)	M. & B.

Fam. ATHERINIDÆ.

ATHERINICHTHYS, <i>Gthr.</i>		
118. <i>*pachylepis</i> , <i>Gthr.</i>	Panama	M.
119. <i>*guatemalensis</i> , <i>Gthr.</i>	Huamuchal	B.

Fam. MUGILIDÆ.

MUGIL, <i>Artedi.</i>		
120. <i>*brasiliensis</i> , <i>Agass.</i>	Atl. & Pac.	M. & F.
121. <i>*incilis</i> , <i>Hancock</i>	Atl. (Chagres)	M. & F.
122. <i>proboscideus</i> , <i>Gthr.</i>	Atl. & Pac. (Cardon)	M. & F.
AGONOSTOMA, <i>Benn.</i>		
123. <i>*microps</i> , <i>Gthr.</i>	Rio Guacalate	F.

124. *nasutum, <i>Gthr.</i>	} Rivers of both sides of C. America (R. San Geronimo, R. Motagua, Panama)	F.
125. *monticola, <i>Bancroft</i>		W. Indies and rivers of both sides of C. America
<i>MYXUS, Gthr.</i>		
126. harcngus, <i>Gthr.</i>	Panama	M.

Fam. FISTULARIIDÆ.

<i>FISTULARIA, Lacép.</i>		
127. tabaccaria, <i>L.</i>	Atl. & Pac.	M.

Fam. GOBIESOCIDÆ.

<i>SICYASES, Müll. & Trosch.</i>		
128. <i>fasciatus</i> , <i>Ptrs.</i>	Puerto Cabello	M.
<i>GOBIESOX, Lacép.</i>		
129. *rhodospilus, <i>Gthr.</i>	Panama	M.
130. <i>nigripinnis</i> , <i>Ptrs.</i>	Puerto Cabello	M.
131. nudus, <i>Bl.</i>	Atl. & Pac. (Cardon)	M.

PHARYNGOGNATHI ACANTHOPTERYGII.

Fam. POMACENTRIDÆ.

<i>POMACENTRUS, C. & V.</i>		
132. *rectifrænum, <i>Gill</i>	Pacif. & Atl.	M.
133. leucostictus, <i>Müll. & Trosch.</i>	Atl.	M.
<i>GLYPHIDODON, Cuv.</i>		
134. saxatilis, <i>L.</i>	Atl.	M.
135. concolor, <i>Gill</i>	Atl. & Pac. (Cardon)	M.
136. declivifrons, <i>Gill</i>	Pac. (Cardon)	M.
<i>HELLASTES, C. & V.</i>		
137. *marginatus, <i>Casteln.</i>	Atl. & Pac.	M.

Fam. LABRIDÆ.

<i>LACHNOLEMUS, C. & V.</i>		
138. falcatus, <i>L.</i>	Atl.	M.
<i>COSSYPHUS, Günth.</i>		
139. rufus, <i>L.</i>	Atl.	M.
140. diplotænia, <i>Gill</i>	Panama, Lower Calif.	M.
141. *pectoralis, <i>Gill</i>	Panama, Lower Calif., St. Helena (? Cuba)	M.
<i>PLATYGLOSSUS, Gthr.</i>		
142. bivittatus, <i>Bl.</i>	Atl.	M.
143. *dispilus, <i>Gthr.</i>	Panama	M.
<i>PSEUDOJULIS, Blkr.</i>		
144. *notospilus, <i>Gthr.</i>	Panama	M.

JULIS, *Gthr.*145. *lucasaua*, *Gill* Panama, Lower Calif. M.SCARUS, *Blkr.*146. *abildgaardii*, *Bl.* Atl. M.PSEUDOSCARUS, *Blkr.*147. *sanctæ crucis*, *Bl.* Atl. M.148. *guacamaia*, *C. & V.* Atl. M.

Fam. GERRIDÆ.

GERRES, *Cuv.*149. *plumieri*, *C. & V.* Atl. F., B., & M.150. **axillaris*, *Gthr.* Chiapam B.151. **brevimanus*, *Gthr.* Chiapam B.152. *rhombus*, *C. & V.* *Atl. & Pac.* (Chiapam) B. & M.153. *squamipinnis*, *Gthr.* (Jamaica) *Atl. & Pac.* (Chiap. & Panama) B. & M.154. *aprion*, *C. & V.* *Atl. & Pac.* (Panama) M.155. **dovii*, *Gill* Pac.

Fam. CHROMIDES.

ACARA, *Gthr.*156. **cæruleopunctata*, *Kner & Steind.* Chagres River F.HEROS, *Gthr.*157. **parma*, *Gthr.* Mexico, R. Chagres & R. Motagua F.158. **margaritifer*, *Gthr.* Lake Peten F.159. **melanopogon*, *Steindachner* ? Lake Peten F.160. **melanurus*, *Gthr.* Lake Peten F.161. **macracanthus*, *Gthr.* Chiapam & Huamuchal F. & B.162. **spilurus*, *Gthr.* Rio Motagua, Yzabal F.163. **nigrofasciatus*, *Gthr.* Lakes of Amatitlan & Atitlan F.164. **multispinosus*, *Gthr.* Lake of Managua F.165. **longimanus*, *Gthr.* Lake of Nicaragua F.166. **urophthalmus*, *Gthr.* Lake Peten F.167. **aureus*, *Gthr.* Yzabal, Rio Motagua F.168. **affinis*, *Gthr.* Lake Peten F.169. **labiatus*, *Gthr.* Lakes of Managua & Nicaragua F.170. **erythræus*, *Gthr.* Lake of Managua F.171. **lobohilus*, *Gthr.* Lake of Managua F.172. **citrinellus*, *Gthr.* Lake of Nicaragua F.173. **altifrons*, *Kner & Steind.* Western Veragua F.174. **friedrichsthalii*, *Heck.* Lake Peten F.175. **salvini*, *Gthr.* Santa Isabel, Lake Peten F.176. **trimaculatus*, *Gthr.* Chiapam, Huamuchal F. & B.177. **dovii*, *Gthr.* Lake of Nicaragua F.178. **motaguensis*, *Gthr.* Rio Motagua F.

179. *managuensis, <i>Gthr.</i>	Lake of Managua	F.
180. *microphthalmus, <i>Gthr.</i>	Rio Motagua	F.
181. *oblongus, <i>Gthr.</i>	Rio Motagua	F.
182. *nicaraguensis, <i>Gthr.</i>	Lake of Nicaragua	F.
183. *godmanui, <i>Gthr.</i>	River of Cahabon	F.
184. *sieboldii, Kner & Steindachner	New Granada	F.
185. *guttulatus, <i>Gthr.</i>	Lake of Amatitlan	F.
186. *irregularis, <i>Gthr.</i>	Rio Usumacinta, S. Geronimo	F.
187. *intermedius, <i>Gthr.</i>	Lake Peten	F.
188. *angulifer, <i>Gthr.</i>	Yzabal	F.
*PETENIA, <i>Gthr.</i>		
189. *splendida, <i>Gthr.</i>	Lake Peten	F.
*NEETROPLUS, <i>Gthr.</i>		
190. *nematopus, <i>Gthr.</i>	Lake of Managua	F.

ANACANTHINI.

Fam. LYCODIDÆ.

*MICRODESMUS, <i>Gthr.</i>		
191. *dipus, <i>Gthr.</i>	Panama	M.

Fam. OPHIDIIDÆ.

BROTULA, <i>Cuv.</i>		
192. *?multibarbata, <i>Schleg.</i>	Pac. coast	M.
DINEMATICHTHYS, <i>Blkr.</i>		
193. marginatus, <i>Ayres</i>	Panama	M.
OPHIDIUM, <i>Cuv.</i>		
194. breviparbe, <i>Cuv.</i>	Atl. & Pac.	M.

Fam. PLEURONECTIDÆ.

CITHARICHTHYS, <i>Blkr.</i>		
195. *spilopterus, <i>Gthr.</i>	Atl. & Pac. (Chiapam)	M. & B.
196. *guatemalensis, <i>Blkr.</i>	Guatemala	
HEMIRHOMBUS, <i>Blkr.</i>		
197. *ovalis, <i>Gthr.</i>	Pac.	M.
PSEUDORHOMBUS, <i>Blkr.</i>		
198. *brasiliensis, <i>Ranzani</i>	Atl.	M.
SOLEA, <i>Gthr.</i>		
199. scutum, <i>Gthr.</i>	Panama	M.
APHORISTIA, <i>Kaup.</i>		
200. *ornata, <i>Lacép.</i>	Atl. & Pac.	M.

PHYSOSTOMI.

Fam. SILURIDÆ.

AMIURUS, Rafn.

201. *mexidionalis, Gthr. Rio Usumacinta F.

PIMELODUS, Gthr.

202. modestus, Gthr. Rio Chagres, Esmeraldas F.
 203. guatemalensis, Gthr. Huamuchal F.
 204. godmanni, Gthr. Lower Vera Paz, Rio Motagua, Mexico F.
 205. *wagneri, Gthr. Pacific & Atlantic rivers of Panama F.
 206. *managuensis, Gthr. Lake of Managua F.
 207. micropterus, Gthr. Rio San Geronimo F.
 208. nicaraguensis, Gthr. Lake of Nicaragua F.
 209. petenensis, Gthr. Lake Peten F.
 210. motaguensis, Gthr. Rio Motagua F.
 211. salvini, Gthr. Rio San Geronimo F.
 212. polycaulus, Gthr. Rio San Geronimo F.

ARIUS, Gthr.

213. guatemalensis, Gthr. Chiapam, Panama B.
 214. *assimilis, Gthr. Lake of Yzabal F.
 215. platypogon, Gthr. San José F.
 216. scemanni, Gthr. — ?
 217. cærulescens, Gthr. Huamuchal F.
 218. troscheli, Gill Pac.
 219. *dovii, Gill Pac.
 220. melanopus, Gthr. Rio Motagua F.
 221. multiradiatus, Gthr. Rio Bayano F.

ÆLURICHTHYS, Baird & Gir.

222. *nuchalis, Gthr. Panama
 223. *panamensis, Gill Panama

PLECOSTOMUS, Gthr.

224. *?sp., Kner & Steindachner Rio Chagres F.

CHÆTOSTOMUS, Heck.

225. *aspidolepis, Gthr. Veragua F.
 226. *?cirrhosus, Val. Rio Chagres F.

LORICARIA, Lacép.

227. *uracantha, Kner & Steindachner Atlantic & Pacific rivers of Panama F.
 228. lima, Kner Atlantic & Pacific rivers of Panama F.

Fam. CHARACINIDÆ.

MACRODON, Müll. & Trosch.

229. *microlepis, Gthr. W. Ecuador, Rio Chagres F.

TETRAGONOPTERUS, Cuv.

230. fasciatus, Cuv. { From Brazil to Mexico (Huamuchal, Rio Guacalate,
 Rio Motagua, Rio Chisoy) F.

231. <i>microphthalmus</i> , <i>Gthr.</i>	Lake of Amatitlan, Pacif. Coast of Guatemala, Peru.	F.
232. <i>panamensis</i> , <i>Gthr.</i>	<i>Panama, Yzabal</i>	F.
233. <i>brevimanus</i> , <i>Gthr.</i>	Rio S. Geronimo, Yzabal	F.
234. <i>petenensis</i> , <i>Gthr.</i>	<i>Lake Peten, W. Ecuador</i>	F.
235. <i>lunilis</i> , <i>Gthr.</i>	Lake of Amatitlan	F.
236. <i>*æneus</i> , <i>Gthr.</i>	Mexico, <i>Pacific & Atlantic rivers of Panama</i>	F.
CHALCINOPSIS, <i>Kner.</i>		
237. <i>*dentex</i> , <i>Gthr.</i>	<i>Rio Motagua and Usumacinta, Yzabal; Ecuador</i>	F.
238. <i>striatulus</i> , <i>Kner</i>	<i>Pacific & Atlantic rivers of Panama</i>	F.
239. <i>chagrensis</i> , <i>Kner</i>	Rio Chagres	F.
ANACYRTUS, <i>Gthr.</i>		
240. <i>*guatemalensis</i> , <i>Gthr.</i>	<i>Rio Chagres, Huamuchal</i>	F.

Fam. SCOPELIDÆ.

SAURUS, *C. & V.*

241. <i>foetens</i> , <i>L.</i>	<i>Atl. & Pac.</i>	M.
242. <i>myops</i> , <i>Bl.</i>	<i>Atl. & Pac.</i>	M.

Fam. SCOMBRESOCIDÆ.

HEMIRHAMPHUS, *Cuv.*

243. <i>unifasciatus</i> , <i>Ranzani</i>	<i>Atlantic, Pacific, & Indian Oceans</i>	M.
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EXOCETUS, *Artedi.*

244. <i>*callopterus</i> , <i>Gthr.</i>	<i>Pac.</i>	M.
245. <i>albidactylus</i> , Gill (? = <i>bahiensis</i> , <i>Ranz.</i>)	} <i>Pac.</i>	M.
246. <i>dovii</i> , Gill	<i>Pac.</i>	M.

Fam. CYPRINODONTIDÆ.

*CHARACODON, *Gthr.*

247. <i>*lateralis</i> , <i>Gthr.</i>	— ?	
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HAPLOCHILUS, *M'Clell.*

248. <i>*dovii</i> , <i>Gthr.</i>	<i>Punta Arenas (Costa Rica)</i>	F.
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FUNDULUS, *C. & V.*

249. <i>*labialis</i> , <i>Gthr.</i>	Rio S. Geronimo, Yzabal	F.
250. <i>*punctatus</i> , <i>Gthr.</i>	Chiapam	B.
251. <i>*guatemalensis</i> , <i>Gthr.</i>	{ Lakes of Dueñas & Amatitlan, Rio Guacalate, W. Ecuador	F.
252. <i>*pachycephalus</i> , <i>Gthr.</i>	Lake of Atitlan	F.

BELONESOX, *Kner.*

253. <i>belizanus</i> , <i>Kner</i>	Lake Peten, Honduras, Mexico	F.
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GAMBUSIA, *Poey.*

254. <i>*nicaraguensis</i> , <i>Gthr.</i>	Lake of Nicaragua	F.
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ANABLEPS, *Artedi.*

255. <i>dovii</i> , <i>Gill</i>	Chiapam	B.
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PECILIA, *Gthr.*

256. <i>mexicana</i> , <i>Steindachner</i>	{ <i>Chiapam, Dueñas, Rio Chisoy, Huamuchal, Lake of</i> <i>Amatitlan</i>	F. & B.
257. <i>thermalis</i> , <i>Steindachner</i>	San Salvador, Mexico	F.
258. <i>chisoyensis</i> , <i>Gthr.</i>	Rio Chisoy	F.
259. <i>*elongata</i> , <i>Gthr.</i>	Panama	
260. <i>*petenensis</i> , <i>Gthr.</i>	Lake Peten	F.
261. <i>dovii</i> , <i>Gthr.</i>	Lakes of Nicaragua & Amatitlan, Mexico	F.
262. <i>*gillii</i> , <i>Kner</i>	Rio Chagres	F.
263. <i>spilurus</i> , <i>Gthr.</i>	— ?	

MOLLIENESIA, *Lesueur.*

264. <i>*petenensis</i> , <i>Gthr.</i>	Lake Peten	F.
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XIPHOPHORUS, *Gthr.*

265. <i>*hellerii</i> , <i>Heck.</i>	Rio Chisoy, Mexico	F.
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GIRARDINUS, *Poey.*

266. <i>*pleurospilus</i> , <i>Gthr.</i>	Lake of Dueñas	F.
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Fam. CYPRINIDÆ.

SCLEROGNATHUS, *Gthr.*

267. <i>meridionalis</i> , <i>Gthr.</i>	Rio Usumacinta	F.
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Fam. CLUPEIDÆ.

CHANOS, *Lacép.*

268. <i>salmoneus</i> , <i>Forst.</i>	Indian & Pacific Oceans (Chiapam)	M. & B.
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ALBULA, *Gronov.*

269. <i>conorhynchus</i> , <i>Bl.</i>	<i>Tropical & Subtropical seas</i> (Panama)	M.
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MEGALOPS, *Lacép.*

270. <i>thrissoides</i> , <i>Schn.</i>	Atlantic	M.
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PRISTIGASTER, *Cuv.*

271. <i>*macrops</i> , <i>Gthr.</i>	Panama	M.
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272. <i>*dovii</i> , <i>Gthr.</i>	Panama	M.
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CLUPEA, *Artedi.*

273. <i>*libertatis</i> , <i>Gthr.</i>	Libertad	M.
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CHATOËSSUS, *C. & V.*

274. <i>*petenensis</i> , <i>Gthr.</i>	Lake Peten	F.
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ENGRAULIS, *C. & V.*

275. <i>brownii</i> , <i>C. & V.</i>	<i>Atlantic & Pacific</i> (Libertad)	M. & B.
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276. <i>*poeyi</i> , <i>Kner & Steindachner</i>	Rio Bayano	F.
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277. <i>*macrolepídota</i> , <i>Kner & Steind.</i>	Rio Bayano	F.
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CETENGRAULIS, *Gthr.*

278. <i>*mysticetus</i> , <i>Gthr.</i>	Pacific coast of Panama	M.
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Fam. GYMNOTIDÆ.

CARAPUS, *Müll. & Trosch.*

279. <i>*fasciatus</i> , <i>Pall.</i>	Rio Motagua	F.
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Fam. MURÆNIDÆ.

OPHIURUS, *Lac.*

280. triserialis, *Kaup.* *Atlantic & Pacific* M.
 281. boro, *Ham. Buch.* *Indian Ocean, West Indies* M., B., & F.
 282. breviceps, *Richards.* *Pacific coast*

MURÆNA, *Cuv.*

283. lineopinnis, *Richards.* *Atlantic & Pacific (Panama)* M.

Fam. SYMBRANCHIDÆ.

SYMBRANCHUS, *Bl.*

284. marmoratus, *Bl.* *Atlantic (Rio Chisoy, Huamuchal, Lake Peten),*
M., B., & F.
 285. immaculatus, *Bl.* *Pacific Coast of Guatemala* M.

PLECTOGNATHI.

DIODON, *Kaup.*

286. sex-maculatus, *Cuv.* *Indian & Pacific Oceans (Panama)* M.

TETRODON, *L.*

287. *politus, *Girard* *San José* M.
 288. *geometricus, *Gthr.* *Panama & Galapagos Isls.* M.

OSTRACION, *L.*

289. cornutus, *L.* *Tropics* M.
 290. bicaudalis, *L.* *Atlantic* M.

BALISTES, *Hollard.*

291. vetula, *L.* *Tropics* M.
 292. *frenatus, *Lacép.* *Indian & Pacific Oceans (Gonzalez Isl.)* M.
 293. niger, *Osbeck* *Ind., Pac., & Atlant. Oceans* M.

ALEUTERES, *Cuv.*

294. monoceros, *Osbeck* *Ind., Pac., & Atlant. Oceans* M.

GANOIDEI.

LEPIDOSTEUS

295. *tropicus, *Gill* *Huamuchal* B.

ELASMOBRANCHII.

MUSTELUS, *Bonap.*

296. *dorsalis, *Gill* *Panama* M.

ACANTHIAS

297. vulgaris, *Risso* *Atl., Ind., & Pac. Oceans (Panama)* M.

CARCHARIAS

298. *maculipinnis, *Poey* *Cuba, Chiapam* M.

ZYGENA, *Cuv.*

299. tiburo, *L.* *Atl.* M.

RHINOBATUS, *Müll. & Henle.*

300. *leucorhynchus, *Gthr.* *Panama* M.

PRISTIS, *Lath.*301. *antiquorum*, *Lath.* *Atl. & Pac. Oceans* (Chiapam) M.UROLOPHUS, *Müll. & Henle.*302. **mundus*, *Gill* *Pac.* M.AËTOBATUS, *Müll. & Henle.*303. **latirostris*, *A. Dum.* *Gaboon, Panama* M.

§ 6. *Partial Identity of the Fish-faunas of the Atlantic and Pacific Coasts of
Central America.*

It will be seen that, as far as our present knowledge reaches, of these 303 species, 173 are truly marine forms, 57 being found on both sides of the Isthmus.

25 have been found in brackish water, of which 3 are found on both sides of the Isthmus.

101 are freshwater fishes, 17 being found in rivers of the Atlantic and Pacific sides.

There will be but very few species which are entirely limited to brackish water, and which may not be with equal propriety added either to the marine or freshwater fauna. Thus, five of the 25 species hitherto known from lagoons with brackish water belong to freshwater genera; and, admitting two groups only, we have

193 marine fish, 59 of which are found on both sides of Central America = 30½ per cent.

106 freshwater fish, 19 being found in rivers of the Atlantic and Pacific sides = 18 per cent.

From the circumstance that our collectors paid more attention to the freshwater than to the marine fauna (at least of the Atlantic coast), we may assume that the proportion between the two groups will be increased by future researches in favour of the marine fauna, but that the proportion between species peculiar to one side and those common to both will be lessened, inasmuch as every collector will discover other Atlantic forms on the Pacific side, and *vice versa*.

The very curious fact of the partial identity of the species of both coasts of Central America was first distinctly stated by myself in the Society's 'Proceedings' for 1861 (p. 370), when, out of fourteen species collected by Capt. Dow on the Pacific side, five were found to be Atlantic forms. To these various others were added by me in the 'Catalogue of Fishes;' and Mr. Gill confirmed this observation in Proc. Ac. Nat. Sc. Philad. 1862, pp. 140, 249. Professor Wagner, in his memoir quoted above (p. 384)¹, has made the same observation; but the species enumerated by him, fourteen in number, are, with one exception, freshwater forms, the geographical distribution of which must have been brought about at periods and in ways different from those of the diffusion of marine species.

Knowing now that at least 30 per cent. of the *marine* fish are found on both sides of

¹ See also 'Record, Zool. Literat.' ii. p. 177.

Central America¹, we cannot account for this fact by resorting to such occasional means of dispersal as the accidental transmission of spawn from one shore to the other by birds or water-spouts, or even the close proximity of the sources of rivers flowing in opposite directions. If we do not adopt the view that species were created at the spot where we find them now, similar creations being produced under similar physical conditions, we have but one way of explaining the partial similarity of these marine fish-faunas, namely, by assuming that the Isthmus did not form a continuous barrier between the two oceans at a former period, but that one or more open channels existed. I am not aware that geology has, up to this time, furnished us with proof positive that this is really the fact; but considering the volcanic nature of Central America, and the absence of all fossiliferous strata, it does not appear too bold an hypothesis to assume that North and South America were formerly connected by a chain of islands similar to that of the Antilles, and that subsequently an elevation (as in other parts of the globe) took place, resulting in the final continuity of dry land: the long-continued activity of the numerous volcanoes may have been another, though secondary cause in filling up the channels on the Pacific side. If such a bodily elevation of Central America has taken place, it is easy to show where some of the broadest channels existed, namely, where we find the greatest depressions running from one ocean to the other. The northernmost of these depressions exists between Tehuantepec and the river Coatzaco; the second is indicated between Puerto Cabello and the Gulf of Fonseca; the third by the Lake of Nicaragua (the remnant and deepest part of a very broad channel); a fourth between Chagres and Panama. (See map, Pl. LXIII., where these supposed former depressions are coloured green.) As far as I have been able to ascertain, the greatest elevation of the first of these lines of depression would be 1500, of the fourth 287 feet only². If we presume that only one of the channels was open at a period when the present marine fauna was already in existence, it will fully explain the existence of identical species on both sides of the isthmus, especially if the difference of the tides was as great as it is now³, causing strong currents from one ocean to the other.

Such an instance of a disconnexion of a marine fauna by elevation of land as I am inclined to assume in the case of Central America does not stand quite alone. We owe to the researches of Prof. S. Lovén and Dr. Malmgren⁴ the knowledge of the fact that marine animals (Crustacea, Annelids, and Fishes) inhabiting the glacial ocean are found in the great freshwater lakes of Sweden and in the Bothnian Gulf, and that this is to be explained only by the former continuity of the Baltic with the Glacial Ocean. During the second half of the glacial period the greater part of Finland and of the

¹ Mr. Darwin ('Origin of Species,' 3rd edit. p. 378) was not acquainted with this fact, which by no means militates against his argument, but merely modifies it.

² M. Wagner, *l. c.* p. 87.

³ At Chagres the mean elevation is 1.16 foot, while at Panama the highest flow is 22 feet. (Seemann, *Voy. of H.M.S. 'Herald,'* i. p. 236.)

⁴ Lovén, *Skand. Naturforsk.-Sällskap. först. offentl. möte d. 9 Juli 1863: Stockholm, 1864.* Malmgren, 'Kritisk Öfversigt af Finlands Fiskfauna,' see 'Zool. Record,' i. pp. 136-138.

middle of Sweden was submerged, and the Baltic was a great gulf of the Glacial Ocean, and not connected with the German Ocean. By the gradual elevation of the Scandinavian continent, the Baltic became disconnected from the Glacial Ocean, and the great lakes separated from the Baltic.

The Isthmus of Suez appears to have been a much more permanent barrier between the faunas of the Mediterranean and the Red Sea. R. A. Philippi has drawn up a list of species of shells common to both faunas; but it was founded on a collection made by Ehrenberg, in which the shells from both seas had been mixed¹; and P. Fischer² has lately shown that the two faunas are quite distinct. As regards the fishes, I have mentioned (on former occasions) a few occurring in both seas (*Sargus noct*, *Sargus rondeletii*); but the number is so small that one might be tempted to account for it by the temporary existence of an artificial communication between the two seas.

Looking at the results of the separation of the Baltic from the Glacial Ocean on the one hand, and of that of the Pacific from the Atlantic on the other, we find them very different. As soon as the continuity of the Baltic with the Glacial Ocean was interrupted, the amount of fresh water carried into the former by rivers exceeded the quantity lost by evaporation of its surface, and the salt water gradually changed into brackish, and in the northern parts into fresh water. By far the greater part of the animals became extinct; but a few survived³, *however, in spite of the greatly altered physical conditions, without altering their specific characters, still agreeing with the typical forms in every point, except in size, remaining smaller, leaner, almost starved*. The same thing might happen if by a rising of the chain of the West-Indian islands the Gulf of Mexico or the Caribbean Sea were at a future time converted into inland seas with narrow outlets into the open ocean.

The separation of the Atlantic and Pacific Oceans was, of course, not accompanied by a change of the water; and any difference that existed in the physical conditions of both seas, as, for instance, the formation of corals on the Atlantic side, and their total absence on the Pacific, existed already before the communication between the oceans was closed; so that the life of species was not in any way affected by the discontinuance of this communication. Let us for argument's sake assume that the part of the isthmus between the Lake of Nicaragua and Panama was once an island, *à peu près* of the form of Cuba, inhabited, like Cuba, on its northern and southern coasts by a certain species of fish. The only effect of a gradual rise of the land on the life of this species would be to force it to retreat further and further from the original coast, and to accommodate itself to the new one—an effect to which, if felt at all, the individuals on the northern and southern coasts would be equally exposed. Thus there is in this case no apparent external cause for an alteration of the species; *and, indeed, the specimens examined by me from opposite coasts of the isthmus are absolutely identical, and there is not the slightest indication that one of them has been modified or degenerated into a climatic or local variety*. I trust that

¹ Martens, in 'Zoolog. Record,' ii. p. 237.

² Journ. Conchyl. xiii. 1865, pp. 241–248.

³ Seven or eight species of the northern part of the Baltic are believed to be of Arctic origin.

geology will furnish us with the proof of the former partial submergence of a part of Central America, as it has done with respect to the northern part of Scandinavia. We should then be able to speak with more confidence of the permanence, or rather endurance, of the characters of a specific type, and arrive at a somewhat more definite idea of the age of species which must have existed before those geological changes were completed¹.

Sir CHARLES LYELL has directed my attention to collateral evidence from other classes of the animal kingdom, by which the partial identity of the faunas of the two coasts is shown, although not in an equally conclusive manner. The majority of malacologists appear to have presumed *à priori* their distinctness, and consequently described Pacific shells generally as distinct from Atlantic species. However, Dr. MÖRCH, in a paper in which he describes or enumerates about 360 Panama species, makes the following remarks (Pfeiff. Malakozool. Blätt. 1859, p. 107):—

“The tropical [molluscan] faunæ may be classed in two principal divisions, the Indian and the Atlantic. To the latter belong, 1, the Guinean (Senegalian); 2, the Antillian; and 3, the Panaman, which, although belonging to the Pacific, appears to be most analogous to the Guinean. A great number of species, especially of Bivalves, have been regarded as identical with those from the eastern (Brazilian) shore. I believe I can prove that they are different. Certain irregular mollusks cannot be separated diagnostically; but I can recognize them by their general habit. It is at all events a fact that no species stamped with definite characters (wohlausgeprägt) is identical on both sides of the isthmus. The Panama species may be divided into:—1, those analogous to West-Indian; 2, those analogous to species from Guinea and Senegal; 3, those very remotely analogous to East-Indian species.”

¹ I may on this occasion recur to a remark made by me in Proc. Zool. Soc. 1858, p. 381, with regard to the sea-snakes observed in the Bay of Panama by M. Sallé, Capt. Dow, and Mr. Salvin. There is now not the least doubt that the snakes seen were *Pelamys bicolor*, and that they are, moreover, very common there. I find that Dr. Seemann (Voy. ‘Herald,’ i. p. 265) already mentions them. But I am much inclined to think that this most common Indian species has migrated eastwards, and that its arrival on the West-American coast is of very recent date. Dampier and the other bucaniers who have left us records of their adventures, and who passed weeks and months in the Bay of Panama, could not have failed to observe them, and to mention them in their notes, just as they did on other occasions. It is also probable that these snakes would have spread into the Atlantic Ocean, had they been so numerous on the Pacific side at the time when a communication existed between the two oceans.

Whilst this paper was passing through the press, I found two notices of the existence of water-snakes on the western coasts of South America, in seas considerably more southwards than the Bay of Panama. The notes are in Capt. Sharp’s Voyage in “The History of the Bucaniers of America.” London, 1699, 8vo, vol. ii. p. 50: “As we sailed” [near Cape St. Francisco, which is nearly under the equator] “we saw multitudes of *Grampusses* every day; as also *Water-snakes* of divers colours.” And p. 72, when sailing in lat. 19° S., the author mentions “A huge shoal of fish, two or three *Water-snakes*, and several *Seals*.” I find in another part of the same work a note which I believe to be the first description of *Tapirus bairdi*. The part has a separate title-page, “A Journal of a Voyage made into the South Sea by the Bucaniers or Freebooters of America from the year 1684 to 1689. Written by the Sieur Raveneau de Lussan.” Loud. 1698, 8vo. The Indian name of the Tapir is given as *Manipourye*, page 16.

These remarks appear to me to convey very strong testimony in accordance with my own observation on the ichthyological fauna, inasmuch as the author refers the Panama Mollusks generally to the Atlantic fauna. He, indeed, denies the perfect identity of the species, admitting merely an "analogy" between them; but then it is a question whether malacologists do not go too far in making specific distinctions, when they are not even able to express those distinctions "diagnostically," recognizing the forms merely "by their general habit." Shells are, after all, that portion of a mollusk the formation and development of which is most influenced by the peculiarities (physical and chemical) of the surrounding medium and locality; and only too many specific forms have been distinguished on account of slight differences in the sculpture and shape of the shells, the importance of which disappears on comparing a large series of examples. However, as I am not prepared to form an opinion with regard to the shells of Central America from my own examination, I am bound to receive the testimony of so celebrated a malacologist as Dr. Mörch; and should his observations prove to be fully correct, they will give an additional interest to this fauna, as proving that the shells of Mollusks suffer change under circumstances in which the specific characters of fishes remain unaltered.

With regard to fossil shells, Mr. J. C. MOORE, who has examined several collections from tertiary beds in San Domingo, has made the observation that "many bear a strong resemblance to shells now living in the Indian Seas and the Pacific, and that one or two appear to be identical" (Quart. Journ. Geol. Soc. 1853, p. 131), and "that a channel or sound may have existed in the equatorial parts during some portion of the tertiary period, by which some few of the tropical shells may have migrated from the one ocean to the other" (ibid. 1850, p. 43).

Of the other marine animals, the *Corals* have been made the object of elaborate researches, the various authors arriving at somewhat different conclusions. First, Mr. DUNCAN, in a paper "On the Fossil Corals of the West-Indian Islands" (Quart. Journ. Geol. Soc. xix. 1863, p. 455), has shown that "in all the calcareous formations which are coralliferous, and are considerably elevated above the level of the Caribbean Sea [being probably of miocene age], there is a very limited series of Corals with generic relation to those now existing and characteristic of the West-Indian Coral Fauna, but a predominance of forms resembling those of the present Coral-seas of the Pacific, South Sea, and the Indian Ocean." This identity of the Corals proves an identical condition of the physical circumstances, and evidently a wide continuity of the West-Indian and Western seas.

On the other hand, Prof. VERRILL, when speaking of the living Polyp-faunæ of the Atlantic and Pacific *sides of Central America* (Proc. Bost. Soc. Nat. Hist. x. 1866, p. 323 *et seq.*), states that their differences of character are very remarkable; that at Panama none of the reef-building corals of Aspinwall, Florida, or the West Indies occur, nor even any of the genera of the families to which they belong, with the

exception of a small *Porites* and *Stephanocora*; that these and other differences do not favour the theory entertained by some geologists, viz. that there has been a communication between the two oceans at this point, and that the Gulf-stream flowed across the isthmus into the Pacific, within comparatively recent geological times.

It is not within the scope of this paper further to discuss the point on which Messrs. Duncan and Verrill are at variance, as we cannot assume that the present fish-fauna existed at so early a period. From the observations made on the fishes and shells we are obliged to conclude that down to a very recent period a connexion between the two seas has been kept open by channels and straits wide enough to allow of the passage of these animals. Why corals, or at least a part of them, should not have been dispersed by their floating germs in a similar manner, is a circumstance which we cannot explain.

The occurrence of identical species of *freshwater fishes* in rivers running to the two opposite oceans is a matter of much less difficulty, and, besides, has been very generally observed in various parts of the globe. The same agencies which in other countries have effected a wider dispersion of one species than of another must have been at work here also. Prof. M. Wagner has, in his Memoir quoted above, so fully treated of this part of our subject, with particular reference to the hydrographical peculiarities of the isthmus, that we need not dwell further on it.

§ 7. *Definition of the Characteristics of the Fish-fauna of Central America.*

In defining the zoological characters of Central America, expressed in its fish-fauna, I confine myself to the freshwater fishes proper. Here the *nearctic* types become extinct, and are represented by five generic types, four of which, although with numerous species in the north, have but a single one here—*Lepidosteus*, *Amiurus*, *Sclerognathus*, and *Haplochilus*. *Fundulus*, extending a little further southwards (with one species in Western Ecuador), is represented by four species in Guatemala. Not one of these species is identical with a North-American.

Much greater is the affinity with *neotropical* types; and their representatives are much more numerous: there is one species of *Acara*, one of *Macrodon*, seven of *Tetraodon*, one of *Anacyrtus*, twelve of *Pimelodus*, one of *Plecostomus*, two of *Chetostomus*, two of *Loricaria*, one of *Anableps*, one of *Carapus*, the latter being identical with a species from Guiana. Types in common with the West-Indian Islands are—*Agonostoma* with three species (one of which is said to be identical with a Jamaican species), *Girardinus* and *Gambusia* with one, the two latter genera being also represented in the Southern States of North America. The Siluroid genus *Arius*, which extends over the tropics generally, is represented by nine species.

Finally, the following genera are peculiar to Central America, or at least have attained there to the greatest development:—*Heros* and the allied *Nectropus* and *Petenia* with thirty-four species, *Ælurichthys* with two, *Chalcinopsis* with three, *Characodon* with one,